# Magma plumbing system during syn-eruptions of two post-caldera volcanoes at Rabaul volcano, Papua New Guinea

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Several post-caldera volcanoes of Rabaul caldera have been active since the last caldera-froming eruption about 1400 years ago. Vulcan and Tavurvur volcanoes, on the western and eastern rim of the caldera, have repeated magmatic eruptions since 19th century. Syn-eruption of those volcanoes occurred three times in AD 1878, 1937 and 1994. Takahashi et al. (2003) revealed eruption sequence and petrological features of juvenile materials of the 1994 syn-eruption, and discussed the structure of magma plumbing system and eruption processes, as follows. Before the eruption, a large zoned magma chamber existed beneath the Rabaul caldera. The chamber was composed of silicic magma (S magma: SiO2=71%, K2O=2%) and mafic magma (M1 magma: SiO2=56%, K2O=3%). Distinct more mafic magma (M2 magma: SiO2=51%) injected into the zoned magma chamber to trigger the 1994 eruption. The eruption began with phreatic eruption of the Tavurvur volcano, which was followed by magmatic eruption of Vulcan volcano. Eruption mode of Tavurvur volcano had soon become magmatic. Then two volcanoes continued eruptive activity simultaneously. Although juvenile materials from Vulcan volcano are mixing products between S and M1 magmas, those from Tavurvur volcano are formed by magma mixing of three magmas, S, M1 and M2 magmas.

In order to investigate temporal evolution of the magma plumbing system beneath Rabaul caldera, we have carried out petrological study for AD 1937 and 1878 eruptions of Vulcan volcano and lavas of the sulfur creek which had been formed near Tavurvur volcano before 18th century. Using compositional variations of phenocrystic minerals, we can identify evidence for magma mixing between S and M1 magma in all of these juvenile materials. Chemical compositions of phenocrystic minerals (plagioclase, orthopyroxene and clinopyroxene) derived from each end-member magma has not changed during more than 300 years. This suggests that the zoned magma chamber was formed before 300 years ago, and that compositions and magmatic temperature of both magmas in the zoned magma chamber have not changed largely during at least 300 years. Although injection and mixing of the M2 magma have not been detected in all the samples, distinct, more mafic magma (M3 magma) occurred as mixing end-member in pumice of 1878 Vulcan eruption. M3 magma should be nearly primitive basaltic magma, because olivine phenocrysts in the magma are extremely magnesian ranging from Fo=88 to 92. On the other hand, olivine phenocrysts from M2 magma range from Fo=80 to 85.

In summary, magma plumbing system of Rabaul volcano consists of shallower zoned magma chamber and deeper mafic (basaltic) magmas. Injection of the mafic magma into the zoned chamber occurred twice in 1878 and 1994, possibly triggering syn-eruption of Vulcan and Tavurvur volcanoes. Although mafic injection is not detected from 1937 Vulcan pumice, evidence for the injection might be found in 1937 Tavurvur lavas as in the case of 1994 eruption. We believe that syn-eruption of two pos-caldera volcanoes have been triggered by injection of mafic magma. According to recent result of seismic tomography around Rabaul volcano(Finlayson et al., 2003), huge low-velocity region (30-35 km3) can be detected at 3-6 km depth beneath the caldera, indicating that separate magma chambers would not exist beneath each volcano. This low-velocity region must correspond to proposed zoned magma chamber. In addition, another low-velocity column could be recognized at deeper than 5km depth beneath the shallower huge low-velocity region. This might suggest the presence of deep sheeted mafic magmas beneath the zoned magma chamber.